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Protsak T.V.,
Hayina N.I.,
Gumenyuk A.L.
Higher State Educational Institution of Ukraine "Bukovinian State Medical University", M.H. Turkevych Department of Human Anatomy, Chernivtsi, Ukraine, tanya-procak@yandex.ru

MODERN LITERARY DATA OF DEVELOPMENT FEATURES CORONAL ARTERIES OF HEART (literature reviev)

Abstract. *Relevance and the social importance of studying development of coronary arteries of heart for the purpose of searches effective treatment and ways of prevention of cardiovascular diseases which are caused by prevalence of the diseases among adult population having the adverse forecast and high death rate. Results of literary search about features of development of coronary arteries of heart are presented in article.*
Key words: *development, heart, coronary arteries of heart.*

In the second half of XX and at the beginning of XXI century non-communicable diseases, primarily cardiovascular deceases which currently are the leading cause of disease incidence, disablement and mortality of adult population, predominantly jeopardize for the health of population and provide the challenge for health protection. Regardless of centuries-long history of heart study as the central organ of cardiovascular system, issues of coronal blood circulation abnormalities till now remain in the public eye of majority of investigators [4, 5, 14, 19], that is why studying of coronal arteries (CA) progression is an actual and expedient issue of nowadays.

Coronal arteries elaboration is the fundamental stage in heart development and includes the chain of consequent phases. Development of arteries of coronary vasculature is a form of vasculogenesis with further angiogenesis. This vasculature uses few unique development processes which are not observed during elaboration of other blood vessels [7, 27]. Distinctive features of this process are commitment of angioblastic cells, interaction brtween angioblastic cells and mesenchyme and also differences in arterial and venous structures [22, 26]. Considering the mechanisms of elaboration of CA divergency from heart, it is worth noting that the heart is originated as nonvascular structure and elements, which direct blood flow towards the myocardium, develop later – at the appropriate development stages [1, 17, 18].

Vasculogenesis process starts from the delivery of vasculogenic types of cells to the surface of heart after the beginning of cardiac beat. These cells settle across the whole heart, differentiate into endothelial cells, unstrained muscle cells, adventitional cells and fibro-blasts, later build up arteries, veins, capillary tubes and connect to aorta and coronal antrum [17, 22, 26]. Spreading of the cell pool that demands active cell fission, and also coordination of cell movements and acute delivery time, commitment and differentiation is crucially important for normal elaboration of vessels [2, 21].

For a long period of time an opinion existed that coronal arteries elaborated out of ecphyma of wall of aortic medulla. This opinion was contradicted at the end of 80th by the series of papers which determined that coronary plexus began elaborating within subepicardium and further infiltrating myocardium [10, 18]. CA develop in two phases: vascular plexus is elaborated and surrounds the heart, and then this plexus transforms into mature vasculature that is joined with aorta.

Inside of the mature heart, junctions that link the plexuses with aorta interpenetrate two hiatuses or orifices through which left and right CA connect to aorta [20, 23, 24]. Thus in early period (9-10 weeks) elements of coronary

vasculature [6] are added to sinusoid type.

The next phase of development of coronary vasculature is linked with elaboration of new vessels, in particular, of capillarity from the primary vascular plexus. Coronary plexus first is formed in the form of multiple primary endothelial locuses which spread from the venous antrum along the anterior ventricle wall in order to elaborate the whole plexus [23]. One of the most interesting aspects of development of coronal vessels is that the huge part of initial differentiation and structure formation occurs without blood flow. Endothelial plexuses are observed across the whole square of grown heart and across the whole wall of trabecular myocardium before connection to aorta [10, 21, 26]. So in the closing stages of vasculogenesis without blood flow, an overall scheme of coronary vasculature is determined, but significant transformation of large vessels and capillarity will occur after connection with aorta [26].

Joining of coronary vasculature to the allover blood-vascular system is complicated development process, and till this moment it is unclear whether it is the motion that is directed to chemotaxis or it is merely “the line of least resistance”. First CA cephalic ends migrate to the proximal aorta. The mockers of coronary vessels penetrate through the middle aortic wall, needle an endothelial lining and create integrity in lumina [25].

Few coronary vessels grow near left and right aortic antrums, but only one of these arteries creates a solid linkage with every antrum and becomes the right or left CA. It is interesting to understand the accuracy of CA linkage with aorta, because they are located in the center of aortic valve [16, 21, 25]. Positioning of every CA varies as throughout the height as along the aorta [9, 24]. Baseline entrances of right and left CA are usually situated at the level of brims of aortic valves, but level of outsets of coronary vessels in regard to half-moon-like valves is variable [16, 24]. Great transformations of coronary vasculature are continued after positioning of chaotically located vascular plexus of arteries, veins and capillary tubes exactly after linkage with aorta [26].

Hiatus of the left CA may be situated on the free edge level of half-moon-like valve (in majority of cases – 42,6%), higher or lower of its edge (in 28 and 29,4% respectively). Positioning of above of free edge of half-moon-like valve is the most often for an entrance of the right CA (51,3% of cases), on the free edge level (30%) or lower than free edge (18,7%) [8, 9, 24].

Bifurcation is the general type of divergency of coronary arteries regardless their diameter. In this type of divergency every vessel (trunk) is divided on two ramuses, the length of each is equal to the distance along the trunk from a vertex of angle of previous divergency [12]. Left CA grows away from the left coronary antrum of aorta and is located between the beginning of pulmonary trunk and the left atrial auricle; it is divided on circumflex artery and ramus interventricularis anterior. Ramus of circumflex artery is directed under the left atrial auricle in coronary transverse on diaphragmatic (back) surface of heart. From the circumflex ramus in upward and descending directions atrial and ventricular ramuses grow away. From 1 to 8 ramuses, which in regard to their topography are divided on anterior, middle and posterior, and regarding length – on short and long, direct towards the atriums [9, 13, 20].

Ramus interventricularis anterior runs down across the sulcus interventricularis posterior to the cardiac apex, and spreads the following ramuses: ramus diagonalis (side ramus); left- and right-ventricular ramuses anterior; ramuses interventricular septal anterior; infundibular conus branch [9, 20]. Ramuses diagonalis (from 1 to 4), which take part in blood supply of lateral left ventricular wall and can anastomose with left ventricular circumflex branch, grow away from the ramus interventricularis anterior of the left CA [9, 11]. In particular cases ramus diagonalis is grown out more proximally, thus three vessels instead of two grow out from the left CA trunk. In this case extra artery grows out from the left chief artery, between ramus interventricularis anterior and circumflex artery, and is called ramus intermedius. This artery ensures blood supply to the anterior segments of free left ventricular wall [1, 13, 15].

From 6 to 10 septal branches, which provide

blood supply to 2/3 of interventricular septum, grow out from the left CA. Properly ramus interventricularis anterior of left CA reaches cardiac apex and supplies it with blood, sometimes it is shifted to the diaphragmatic surface of heart, anastomosing with posterior interventricular artery of heart, ensuring collateral blood flow between left and right CA. Circumflex artery lies in left atrioventricular sulcus and has one or more branches which reach blunt heart edge, that ensures blood supply of the lateral and posterior left venticular wall. Moreover vital atrial arteries grow out from the circumflex ramus [9, 15].

Left CA in comparison with the right CA has shorter trunk that in majority of cases is situated behind the pulmonary trunk root. Right CA after going out of aorta circumvents the right atrial auricle, then goes across the coronary transverse to the right, then – back, reaches direct sulcus interventricularis posterior, along which it runs down to the cardiac apex and is called posterior interventricular artery [3]. Right CA releases atrial and ventricular branches, ensuring blood supply of right atrium, the part of anterior and whole posterior surface of the left ventricle, interatrial septum and rear third part of interventricular septum [1, 9, 24].

Approximately in 90% of cases artery of atrioventricular ganglion goes out of right CA and only in 10% – from the circumflex artery. In certain cases both arteries – right coronary and circumflex arteries take part in elaboration of descending CA posterior. Many academics including W. Fulton, D. Lewin, G. Gadiner maintain an opinion that ramus interventricularis anterior plays a key role, the circumflex ramus plays medium role and the right CA plays insignificant role in the myocardium vascularization. Because regardless the type of heart blood supply, three times more blood flows through the left CA than through the right CA [1, 9].

So the development of CA is the complicated complex of controllable processes, which induce dramatic implications in physiology of human organism.

As of today the prospect of investigation of CA development remains in the focus of attention, because issues of coronal blood flow abnormality are the leading causes of disease incidence, disablement and mortality of population.

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